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(54) **Surface material for sanitary articles and its preparing method.**

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## Description

This invention relates to a surface material in accordance with the preamble of claim 1.

US-A-4,214,582 (D1) discloses a surgical dressing comprising a surface sheet consisting of three layers. A surface layer of substantially hydrophilic fibers is placed between two layers of predominantly hydrophobic fibers. The surface sheet should have a good permeability in order to improve the absorbent characteristics, but should be relatively nonadherent to the wound.

EP-A-0 059 498 (D2) describes an absorptive device including a facing element consisting of hydrophobic fibers which is backed up by a support element which may also consist of hydrophobic filaments.

It is commonly known that the structure of absorbent products which are used in order to absorb and retain liquids that are produced from the body involves an absorber, which absorbs and retains liquids, interposed between a surface material, which is permeable to liquids, and a leak-proof material, which is impermeable to liquids. In such absorbent products, aside from the obvious characteristic of quickly transferring the liquid to be absorbed to the absorber, it is necessary that the liquid-permeable surface material (which is also sometimes referred to as the outer wrapping, covering, top sheet or cover stock) not give an unpleasant feeling to the user by not allowing backflow of the liquid that has moved into the absorber (to be referred to as backflow prevention), not give an unpleasant feeling to the user by not allowing the surface to become stained when absorbing colored liquids such as fecal material or blood (to be referred to as stain prevention), not allow the liquid that has been absorbed into the absorber to leak from the ends of the sanitary article through the surface material, and also provide adequate ventilation.

In order to achieve this objective, various proposals have been made and techniques to improve upon these proposals are also numerous.

Specifically, to begin with, instead of hydrophilic materials such as pulp or rayon which have been typically used in the past for the component materials of the surface material, there is an example of the prior art which improves the prevention of backflow by the formation of a region of hydrophobic atmosphere between the Surface of the body and the absorber using hydrophobic synthetic fibers such as polyolefine and polyester (Pat. Disclosure SHO 58-180602). Although backflow prevention is improved considerably as a result of this, there is an inevitable occurrence of a reduction in liquid permeability.

Therefore, although techniques have been proposed which allow both liquid permeability and backflow prevention to co-exist by composing the surface material blending both hydrophobic fibers and hydrophilic fibers (Pat. Disclosure SHO 55-68367, Pat. Disclosure SHO 57-136454) or using a hydrophobic fiber following hydrophilic treatment of the surface (Pat. Disclosure SHO 54-163136), in these methods, it still remains extremely difficult to make these two properties compatible with each other.

In addition, other techniques have been proposed which attempt to solve the above problems by providing holes in hydrophobic nonwoven fabric or film and placing a hydrophilic fiber beneath it, followed by further allowing the lower hydrophilic fiber to penetrate to the surface of the holed portion (Pat. Disclosure SHO 57-1339 and Pat. Journal SHO 59-36534).

However, in the case of actually using such surface materials, when pressure is applied due to movement of the user, since liquid that has migrated to the absorber easily transfers to the body surface, backflow prevention was inadequate. Moreover, since the lower hydrophilic fiber layer is visible through the holes, stain prevention was poor.

On the other hand, although there were also techniques which solved the above problems by extending hydrophilic fibers into a hydrophobic surface material using fluid differential pressure or needle punch, etc. (Pat. Journal SHO 59-32456), since effectively extending the hydrophilic fibers is extremely difficult in consideration of the accompanying complexity of the manufacturing process, anticipated effectiveness was not obtained.

The underlying problem is therefore to provide a surface material having both superior liquid permeability and backflow prevention, and an improved method for preparing this material.

To overcome this problem, the present invention provides a surface material for sanitary articles according to the preamble of claim 1 wherein at least the portion of the first layer covering the second layer has an embossed structure and possesses a first section having a given fiber density, a second section of which the fiber density is higher than said given fiber density of the first section, and a third section which is located at a boundery between said first and second sections, where the area of the third section occupies 2 to 50 % of the area of the entire surface material.

Therefore, this invention provides a nonwoven fabric to function as a surface material of a sanitary article in which the surface material quickly absorbs excreted liquids, suppresses the phenomenon of backflow of the absorbed liquid, and moreover, restricts any oozing or leaking of absorbed liquid from the

edges of the sanitary article.

In addition, the present invention provides a preparing method according to the preamble fo claim 2 wherein with respect to the direction of flow of the fiber aggregate, the web of the second layer is suctioned and removed at fixed intervals with respect to the horizontal direction prior to lamination of the first layer and the second layer, and following lamination, the central portion of the portion that is essentially the first layer only is slit and wound so that the second layer does not exist at a fixed width on both ends in the horizontal direction of the sanitary article.

In describing a suitable form of embodiment of the preparing method of this invention, the main component of the first layer is heat-fusing short fibers and comprises 50% or more hydrophobic fibers. Said fibers are formed into a web with a carding machine. The second layer minimally contains heat-fusing short fibers where 50% or more are hydrophilic fibers. Said fibers are also formed into a web with a carding machine. The webs of the first layer and the second layer that have been obtained in this manner are either laminated after forming fiber aggregates by fusing with separate heating rollers or heating fluids, or the webs of the first layer and the second layer are laminated and then simultaneously formed into fiber aggregates by fusing using a heating roll or heating fluid. Following this, by passing the fiber aggregates in the laminated state through an ultrasonic wave type or heating roll type engraving roll and partially compression bonding and/or fusing, they are given so-called embossing. In this embossing, an arbitrary embossed pattern is formed which possesses section A of which fiber density is comparatively low, section B of which fiber density is comparatively high and section C which is located at the boundary of portions A and B, where the surface area ratio of section C is 2-50% with respect to the total surface area of the embossing.

Further, in this invention, embossing is performed on the first layer for at least the portion which covers the second layer. In portions where the second layer is not present and is composed of the first layer only, embossing may or may not be performed.

In the following, the invention will be described more specifically by way of examples, in connection with the accompanying drawings, in which:

Figs. 1-3 are cross-sectional diagrams which indicate conventional surface materials, Figs. 4-7 are cross-sectional diagrams which indicate embodiments of the surface material of this invention, Figs. 8-13 are front views which indicate the surface material of this invention, Fig. 14 is a diagram which indicates the method of measurement of maximum absorption volume, Fig. 15 is a top view of the surface material in order to determine the dimensions of each section of the embossing pattern, Fig. 16 is a cross-sectional diagram of the surface material in Fig. 15, Fig. 17 is an enlarged diagram of Fig. 16, Fig. 18 is an oblique angle diagram of one example of the equipment used in the preparing method of this invention.

Fig. 1 shows a conventional surface material comprising a first layer 1, which is composed of hydrophobic fibers that are located on the surface in contact with the skin, and a second layer 2, which is composed of hydrophilic fibers lying beneath the first layer 1. The layers 1, 2 are formed into a single unit, and the fiber density of layer 1 is essentially uniform. In this type of composition, although there is a high degree of backflow prevention when the thickness of layer 1 is comparatively large, it has poor liquid permeability. In the case the thickness of layer 1 is comparatively small, in contrast, although it has ample liquid permeability, backflow prevention is poor. If the thickness of layer 1 is of an intermediate thickness, both liquid permeability and backflow prevention become inadequate, and in either case, the co-existence of both liquid permeability and backflow prevention is fundamentally impossible.

Fig. 2 shows a conventional surface material which is also composed by forming a hydrophobic first layer 1, which is located on the surface in contact with the skin, into a single unit with a hydrophilic second layer 2 beneath layer 1. In the embodiments shown in Fig. 2 and 3, the hydrophobic layer 1 is provided with holes 10. In the embodiment shown in Fig. 3, the hydrophilic layer 2 comprises portions 11 which penetrate to the surface through the holes 10. In this type of composition, as was described previously, when pressure is applied due to movement by the user, since liquid that has migrated to the absorber easily transfers to the body surface from holes 10 , the surface material that is obtained has inadequate backflow prevention.

In contrast to this and as depicted in Fig. 4, the surface material of this invention is composed of a first layer 1, which is located on the surface in contact with the skin, and a second layer 2, which is formed into a single unit with layer 1 located beneath layer 1 such that its entire surface is essentially covered by layer 1. Layer 2 is composed of 50% or more hydrophilic fibers. Additionally, the first layer 1 comprises a section A where the fiber density is comparatively low, a section B where the fiber density is comparatively high, and a section C which is located at their boundary. Although the surface layer of section A is at a considerable distance from the hydrophilic layer 2 and has superior backflow prevention, since its fiber density is low and it has ample porosity, it possesses some degree of liquid permeability. In addition,

although section B has extremely superior backflow prevention due to it having high fiber density with the fibers existing close to one another resulting in low porosity, it essentially has no liquid permeability. Section C is located at the boundary between section A and section B, and since the fiber density is intermediate while its surface layer is at a small distance from the hydrophilic layer 2, although it has extremely superior liquid permeability, it has poor backflow prevention.

According to this invention, by making the proportion of the area of this type of section C to the total area of the surface material (referred to as the surface ratio of the section C, refer to the embodiments for the method of measurement) 2-50%, it becomes possible for the first time to obtain a surface material having both superior liquid permeability and backflow prevention characteristics. If the surface area ratio of section C is less than 2%, the necessary degree of permeability will not be able to be obtained, and if it exceeds 50%, the necessary degree of backflow prevention will be unable to be obtained. Therefore, these will not fulfill the intentions of this invention.

The desirable value for the surface area of section C varies according the planar form, etc. of the surface material. For example, in the case section B is in the form of lines as is indicated in Figs. 8 and 9, a value of 2-20% is preferable with a value of 2-10% being more preferable. In addition, in the case section B is in the form of dots as is indicated in Figs. 10 and 11, a value of 10-40% is preferable with a value of 20-35% being more preferable.

Although it is possible for section B to be in the form of lines as indicated in Figs. 8 and 9 with the surface material having a planar form, in consideration of ventilation, it is preferable that section B be in the form of dots as indicated in Figs. 10 and 11.

If the weighting of layer 1 and layer 2 is essentially uniform, the fiber density of layer 1 is uniquely controlled by the thickness of the surface material. The greater the thickness of the surface material, the lower the fiber density, and the smaller the thickness of the surface material, the greater the fiber density. Since a thickness which provides preferable fiber density for each of the portions A, B and C varies according to the type of fiber that is used, etc., such thickness is not strictly limited. However, in general, a thickness of 0.2-2.0mm for section A is preferable, with 0.3-1.0mm being more preferable and 0.3-0.6mm being even more preferable. In addition, a thickness of 0.01-0.30mm for section B is generally preferable, with 0.02-0.20mm being more preferable, and 0.03-0.06mm being even more preferable. Further, a thickness that is intermediate to the thicknesses indicated above is preferable for section C. If sections A and B are too thin, backflow prevention will be reduced and conversely, if they are too thick, liquid permeability will be poor. Thus, either of these conditions is not preferable. In addition, if section A is too thin, since parts of layer 2 will be exposed to the surface, backflow prevention will be lowered. Conversely, if section A is too thick, since the liquid permeability of section C will be decreased, both of these conditions also are not preferable.

The following provides a detailed description regarding layers 1 and 2 of this invention.

Although layer 1 requires that it contain at least 50% hydrophobic fibers, in consideration of backflow prevention, it is more preferable that it be composed only of hydrophobic fibers. In the case the amount of hydrophobic fibers is less than 50%, although layer 1 will have increased wetness and favorable moisture absorption, when used as the surface material of a sanitary article, the sense of dryness of the surface will be impaired.

Although the type of hydrophobic fiber that is used is not subject to any particular limitations allowing selection to be made freely from commonly known types such as polyolefine, polyester, acrylic and polyamide fibers, in consideration of heat processing properties and ventilation, polypropylene, polyester, polyethylene-polypropylene compound fibers, polyethylene-polyester compound fibers, and low melting point polyester-polyester compound fibers are preferable. Although such hydrophobic fibers can be used as is without treating, in consideration of ease of processing, it is preferable that for example, such fibers be treated with antistatic substances such as fluoride compounds having water repelling capability, paraffin-based waxes, or alkylphosphate metal salts, etc. Although such antistatic substances may be of slight hydrophilic nature, it is necessary to determine the composition and amount applied so that the hydrophilic nature of layer 1 does not exceed that of layer 2. In consideration of liquid permeability and ventilation, fiber width of 0.3-10d is generally preferable, with 2-4d being more preferable.

Although the planar form of section A may be such that the surface layer is flat, if it is depressed at sections B and C as in Figs. 4, 6 and 7, since contact of the skin of the user with section B, which has high rigidity and is a factor causing poor ventilation, as well as section C, which has poor backflow prevention, is prevented, this is extremely desirable.

Weighting of layer 1 should be established giving consideration to liquid permeability and backflow prevention. In general, weighting of 5-50g/m$^2$ is preferable, and more preferable if 10-25g/m$^2$.

When considering staining prevention, it is preferable that the fibers of layer 1 be opaque. If the fibers are opaque, the surface material of this invention will also be opaque. Since this will allow the surface material to effectively cover up the colors of adhered liquids such as blood or fecal material, stain prevention will be improved. Although the opaqueness of this surface material is quantified in terms of whiteness (see embodiments), it is preferable that such whiteness be 20% or more, with 30% or more being more preferable. Furthermore, various methods can be considered for giving the desired degree of opaqueness. An example of such method involves adding white pigment to resin in the fiber manufacturing process. However, as long as it is possible to give the desired degree of opaqueness, any method may be used without being limited to methods like that above. In addition, in the case of using compound fibers such as polyethylene-polypropylene compound fibers or polyethylene-polyester compound fibers, it is preferable to make the white pigment ubiquitous in high melting temperature resin within the fibers since this effectively improves stain prevention.

In order to prevent tearing or unraveling of the surface material, it is preferable that the fibers of layer 1 be sufficiently intertwined, or depending on the case, adhered to each other in the same manner as nonwoven fabric of conventional absorbent products. Although intertwining can be performed by high pressure fluids and adhesion performed using an adhesive or thermal adhesion, thermal adhesion is more preferable in consideration of liquid permeability and ventilation. Incidentally, adhesion may be performed uniformly within layer 1 or distributed regularly or irregularly.

On the other hand, although layer 2 requires that it contain at least 50% hydrophilic fibers, in consideration of liquid permeability, it is preferable that it consist of hydrophilic fibers only.

Although fibers composed of hydrophilic substances such as pulp or rayon, as well as fibers in which the surfaces of fibers composed of hydrophobic substances such as polyolefine, polyester, acrylic or polyamide fibers which have undergone hydrophilic treatment using suitable methods, can be used for the hydrophilic fibers, in consideration of backflow prevention and ventilation, the latter are preferable. From among these, in consideration of ease of heat processing and ventilation, those in which the surface of polypropylene, polyester, polyethylene-propylene compound fibers, polyethylene-polyester compound fibers or low melting point polyester-polyester compound fibers have undergone hydrophilic treatment similar to those of layer 1 are more preferable. In other words, hydrophilic fibers refers to fibers in which a surface active agent possessing hydrophilic function, such as the ethylene oxide adduct of sulfonic acid chloride or the ethylene oxide addition product of sulfuric ester chloride, is added to said thermoplastic fiber, or fibers which are hydrophilic by nature such as rayon or cotton. In the case the amount of hydrophilic fibers is less than 50%, the wetting and absorption properties of layer 2 will be reduced excessively such that when used as the surface material of a sanitary article, liquid absorption will be decreased remarkably due to layer 1 being composed of 50% or more hydrophilic fibers. In consideration of backflow prevention and ventilation, a fiber width of 0.3-10d is preferable, with 2-4d being more preferable.

The weighting of layer 2 also should be established in consideration of liquid permeability and backflow prevention. In general, 10-50g/m$^2$ is preferable, with 15-40g/m$^2$ being more preferable.

In addition, in the same manner as layer 1, it goes without saying that opaque fibers should be used in order to improve stain prevention.

Although the thickness of layer 2 may be essentially uniform as in Figs. 4 and 5, it is more preferable if the thickness of layer 2 is made thinner beneath sections A and C of layer 1 as in Figs. 6 and 7 since this results in increased liquid diffusivity thereby improving the liquid permeability of the surface material. In addition, although it is possible to make all of layer 2 exist beneath layer 1 as in Figs. 4-6, it is extremely desirable if it is made to exist only at the central portion of layer 1 as in Fig. 7 since diffusion of liquid at both edges of the surface material is reduced resulting in a dramatic improvement in leakage prevention.

Although it is required that layers 1 and 2 be formed into a single unit, it is preferable that they be formed into a single unit to a degree such that they at least do not come apart during use. Although examples of methods to accomplish this include thermal adhesion by hot air treatment, etc., thermocompression bonding by thermal embossing or ultrasonic embossing, etc., adhesion using an adhesive and intertwining using an air flow or high pressure water flow, in consideration of ventilation and productivity, etc., it is preferable to form sections B and C on layer 1 by ultrasonic embossing treatment after first performing thermal adhesion of layer 1 and layer 2 using hot air treatment.

In the preparing method of this invention, the purpose of performing so-called embossing by laminating layers 1 and 2 and passing them through an ultrasonic wave type or heating roll type of engraving roll followed by partial compression bonding and/or fusing is that liquid absorption would be low or completely absent if the layers were simply laminated only due to layer 1 being essentially hydrophobic and layer 2 being essentially hydrophilic. As such, the inventors discovered that liquid absorption would be exhibited by making the layers thinner in parts by embossing in a laminated state.

Although the mechanism of this is not clear, it is believed that liquid absorption is exhibited by shortening the distance in the thickness direction between essentially hydrophobic layer 1 and essentially hydrophilic layer 2. In actuality, liquid absorption is demonstrated remarkably in section C at the boundary of section B, which is compression bonded and/or fused and has comparatively high fiber density, and section A, which is not compression bonded and/or fused and has comparatively low fiber density. Therefore, since if the weighting of layer 1 is too high, liquid absorption decreases, and conversely, if it is too low, liquid backflow occurs easily, weighting of 10-25g/m$^2$ is preferable. On the other hand, since if the weighting of layer 2 is too high, liquid retention is increased and backflow occurs easily, weighting of 10-25g/m$^2$ is preferable.

In this invention, a pattern is selected and used which possesses section A, which has comparatively low fiber density, section B, which has comparatively high fiber density, and section C, which is at the boundary between them, by compression bonding and/or fusing so that the surface area ratio of section C is 2-50% with respect to the total surface area of the embossing. In the case said surface area ratio is less than 2%, liquid absorbing portions are too few causing liquid absorption to become extremely poor. In addition, if said surface area is greater than 50%, although liquid absorption is favorable, since the thickness of the surface material becomes extremely thin and moreover, due to reduced ventilation, on the contrary, liquid backflow becomes worse.

Examples of embossing methods include a method in which one or both rolls pass through an opposing heating roll having an engraving pattern which satisfies the above surface area ratio, and a method in which one or both rolls pass between a non-heating engraving roll having the above pattern and an ultrasonic oscillation horn.

In regard to the preferable form of the preparing method of this invention, in order to inhibit and prevent the leakage of absorbed liquid in the horizontal direction, the web of layer 2 is suctioned and removed at fixed intervals with respect to the horizontal direction prior to lamination of layer 1 and layer 2 with respect to the direction of flow of the fiber aggregates. Following lamination, a slit is made in the center of the formed portion which is essentially layer 1 only followed by winding. The nonwoven fabric that is prepared in this manner following slitting is able to inhibit and prevent staining and leakage in the horizontal direction when using in the surface materials of sanitary articles since layer 2 does not exist at a fixed width on both ends in the horizontal direction and both ends are essentially formed from hydrophobic fibers. In contrast to the web width of ordinary nonwoven fabric production machines being on the order of 1-2.5m, since the width when used in the surface materials of sanitary articles is on the order of 0.1-0.5m, a multiple number of rolls are produced as surface materials of sanitary articles. Therefore, the web of layer 2 is removed at a multiple number of locations at fixed intervals with respect to the horizontal direction. Examples of methods which can be used for the above web removal method for layer 2 include a method in which a metallic wire wound onto a carding roller is wound at fixed intervals in the horizontal direction, a method in which following forming of the web over the entire width of the carding, the web is removed by suctioning while simultaneously cutting at fixed intervals with a slitter, and a method in which while holding down the web at fixed intervals with a plate on a roller at the outlet of the carding machine, the portions of the web that are not being held down are removed by suctioning.

The following is a detailed description of one of the preparing methods as indicated in Fig. 18. Fig. 18 shows a web which forms layer 1 coming out of a carding machine 22 and moves onto conveyor 3 . Continuing, the web of layer 2 is formed from carding machine 4 . Providing a multiple number of plates 5 of fixed width on the roller at the outlet of carding machine 4 at fixed intervals, the portions of the web which are not being held down with said plates are suctioned and removed with suction nozzles 6 . It is preferable that the web that has been suctioned and removed be returned again to the entrance of carding machine 4 from the viewpoint of reducing loss of raw stock. Then, web which forms layer 1, and web 7 , which is remaining after suction and removal and forms layer 2, are laminated to form sheet 9 by passing through hot air chamber 8 to fuse the fibers. Following this, embossing is performed by passing through calender rollers 10 and between ultrasonic wave generator horn 11 and engraving roll 12 . The center of the portion of layer 1 only is cut with slitter 13 after which the laminated material is wound into roll form 14 .

Although the following provides a description of the surface material of this invention using the example of disposable diapers, this invention is not limited to these embodiments, but can also be applied for use in other sanitary articles such as sanitary napkins and sanitary pads.

The surface materials indicated in Table 1 and Table 2 were prepared with the specified methods using the component materials indicated in Table 1. The following describes the measurement methods for shape and performance of each of the surface materials. Furthermore, the values indicated in Table 1 and Table 2 are the average values of 10 measured values.

(1) Shape

i) Dimensions of Each Section

Photographs of the flat and cross-sectional surfaces of the surface materials (embossed portions) were taken using a scanning electron microscope. The length p of the embossed portion in the photographs as well as the length q of the periphery of the embossed portions were measured (Top View: Fig. 15). In addition, straight lines $l_1$ and $l_2$ in cross-sectional diagrams Figs. 16 and 17 essentially define the thickness $t_1$ of the embossed portion (fiber compression bonding portion). Next, the thickness $t_2$ of the fiber non-compression bonding portion is determined according to straight lines $l_7$ and $l_8$ which are essentially tangent to the flat portion. Further, straight lines $l_3$ and $l_4$ are erected from both ends of the fiber compression bonding portion in a direction perpendicular to straight line $l_2$, and similarly, straight lines $l_5$ and $l_6$ are erected from both ends of the fiber non-compression bonding portion in a direction perpendicular to straight line $l_7$. At this time, the distance between lines $l_3$ and $l_4$ expresses the dimensions of b, the distance between lines $l_4$ and $l_5$ expresses the dimensions of c, and the distance between lines $l_5$ and $l_6$ expresses the dimensions of a.

In addition, the distance which connects intersection point $C_1$ of lines $l_4$ and $l_2$ and intersection point $C_2$ of lines $l_5$ and $l_7$ is taken to be d.

ii) Surface Area Ratio of Section C

The surface area ratio of Section C is calculated using the following equations using the values of each of the portions obtained from i) above.

Surface Area of Fiber Compression Bonding Portion (Section B)

$$M_B = b \cdot p \times 10^3 \ (mm^2)$$

Surface Area of Fiber Non-Compression Bonding Portion (Section A)

$$M_A = a \cdot (a + 2b + 3c) \times 10^3 \ (mm^2)$$

Surface Area of Middle Portion (Section C)

$$M_C = 2 (p + q) \cdot d \times 10^3 \ (mm^2)$$

Surface Area Ratio of Section C:

$$\frac{M_C}{M_A + M_B + M_C} \ (\%)$$

$$= \frac{2(p + q)d}{a^2 + b(2ab + p) + 3ca + 2(p + q)d}$$

(2) Performance

At the time of evaluation, the surface material of a commercially available disposable diaper was removed and replaced with each of the surface materials to be evaluated. These were then evaluated as the hypothetical disposable diaper samples. Furthermore, in Embodiment 6, section B and section C were formed by superimposing layer 2 on the central portion of layer 1 in the horizontal direction and performing ultrasonic wave embossing on the portions where layer 2 was present as indicated in Fig. 12. In addition, in Embodiment 7, section B and section C were formed by superimposing layer in the central portion of layer 1 in both the horizontal and vertical directions and performing ultrasonic wave embossing on the portion where layer 2 was present as indicated in Fig. 13.

i) Absorption Time and Liquid Backflow Volume

A specified amount of test liquid was injected under pressure onto the hypothetical disposable diaper sample. The amount of time required to absorb the liquid was taken to be the absorption time. In general, the shorter this absorption time, the more superior the liquid permeability of the surface material. Further, the amount of test liquid that flows back from the inside of the sample through the surface material applying high pressure after a fixed amount of time was taken to be the liquid backflow volume. The smaller the liquid backflow volume, the smaller the degree of stickiness of the surface indicating a more pleasant feel when used.

ii) Stain Prevention

The state of the hypothetical disposable diaper sample was divided into the three ranks indicated below following the absorption of a colored test liquid.

Class 3: Color of test liquid can hardly be observed
Class 2: Color of test liquid is slightly observed
Class 1: Color of test liquid can be observed remarkably to an extent of being unpleasant

iii) Maximum Absorption Volume

The maximum absorption volume was taken to be the amount of test liquid injected at the point leakage is observed by placing an infant model 16 horizontally, putting the hypothetical disposable diaper sample 17 on the model and injecting the test liquid from tube 18. The greater this maximum absorption volume, the more superior the stain prevention.

iv) Ventilation

The feel when a hypothetical napkin sample is touched with the hand divided into the three ranks indicated below.

Class 3: Soft
Class 2: Somewhat stiff
Class 1: Stiff and unsuitable as a surface material

The processing agents a and b used in Table 1 are as indicated below.

a: Fiber processing agent of which the main component is alkylphosphate (a is less hydrophilic than b).
b: Fiber processing agent of which the main component is alkylphosphate to which polyethylene glycol has been added.

Table 1

| | | Layer 1 | | | | | Layer 2 | | | | | Preparation Method | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Composition | Processing Agent | Weighting g/m2 | Stabilization Method | Dimention mm | Composition | Processing Agent | Weighting g/m2 | Stabilization Method | Dimention mm | Unification Method | Forming Method |
| Embodiments | 1-5, 8 | ES 2d 100% | a | 19 | Thermal Adhesion | 460 x 310 | SH 3d 100% | b | 16 | Thermal Adhesion | 460 x 310 | Thermal Adhesion | Ultrasonic Wave Treatment |
| | 6 | " | " | 21 | " | " | " | " | 15 | " | 460 x 200 | " | " |
| | 7 | " | " | 21 | " | " | " | " | 16 | " | 460 x 200 | " | " |
| | 9 | " | " | 20 | " | " | ESHB 3d 100% | " | 14 | " | 460 x 310 | " | " |
| | 10 | ES 2d 70%<br>ESHB 2d 30% | a<br>b | 22 | " | " | SH 3d 100% | " | 15 | " | " | " | " |
| Comparative Example | 1 | ES 2d 50%<br>SH 3d 50% | a<br>b | 35 | " | " | - | - | - | - | - | - | - |
| | 2 | ES 2d 100% | a | 20 | " | " | SH 3d 100% | b | 16 | Thermal Adhesion | 460 x 310 | Thermal Adhesion | - |
| | 3 | " | " | 22 | " | " | " | " | 15 | " | 460 x 310 | " | - |
| | 4-5 | ES 2d 100% | " | 19 | " | " | " | b | 14 | " | " | " | Ultrasonic Wave Treatment |

(Notes) ES: Polyethylene-Polypropylene compound fiber (flat crimped type, Chisso Co., Ltd.)
ESHB: Polyethylene-Polypropylene compound fiber (solid crimped type, Chisso Co., Ltd. )
SH: Polyethylene-Polyester compound fiber (flat crimped type, Daiwa Spinning Co., Ltd.)

Table 2 Shape and Performance

| | Shape | | | | Performance | | | | Remarks |
|---|---|---|---|---|---|---|---|---|---|
| | Surface Area Ratio of Section C % | Thickness Section A um | Thickness Section B um | Flat Shape | Absorption Time - Second | Backflow Volume q | Staining Prevention - Class | Maximum Absorption Volume q | Ventilation - Class | |
| Embodiment 1 | 8 | 462 | 44 | Fig. 10 | 66 | 0.06 | 3 | 115 | 3 | |
| 2 | 28 | 453 | 47 | " | 42 | 0.08 | 3 | 126 | 3 | |
| 3 | 44 | 446 | 51 | " | 38 | 0.25 | 2 | 108 | 2 | |
| 4 | 29 | 460 | 15 | " | 37 | 0.19 | 2 | 105 | 2 | |
| 5 | 30 | 462 | 139 | " | 53 | 0.06 | 3 | 111 | 3 | |
| 6 | 29 | 460 | 50 | " | 43 | 0.08 | 3 | 194 | 3 | |
| 7 | 30 | 462 | 49 | " | 42 | 0.08 | 3 | 253 | 3 | |
| 8 | 4 | 426 | 34 | Fig. 8 | 75 | 0.05 | 3 | 119 | 2 | |
| 9 | 29 | 455 | 51 | Fig. 10 | 43 | 0.11 | 3 | 116 | 3 | |
| 10 | 33 | 469 | 52 | " | 40 | 0.15 | 2 | 103 | 3 | |
| Comp. Ex. 1 | 0 | - | - | - | 33 | 1.44 | 1 | 52 | 3 | |
| 2 | 0 | - | - | - | 126 | 0.02 | 2 | 67 | 3 | |
| 3 | 0 | - | - | - | 38 | 1.63 | 1 | 42 | 1 | |
| 4 | 1 | 573 | 31 | Fig. 8 | 114 | 0.04 | 2 | 66 | 3 | |
| 5 | 65 | 375 | 35 | Fig. 10 | 34 | 0.54 | 2 | 76 | 1 | |

The following indicates embodiments of the preparing method of this invention.

Embodiment 11

Layer 1 was formed by adding 0.3 wt.% hydrophobic surface activating agent of which the main component is alkylphosphate K salt to the surface of 51mm of 2 denier heat-fusing short fiber of polypropylene-polyethylene core sheath structure (ES Fiber, Chisso Co., Ltd.) and forming a hydrophobic web having a weighting of 20g/m$^2$ with 100% of said fiber using the carding machine 22. Layer 2 was formed by adding 0.3 wt.% hydrophilic surface activating agent of which the main component is the polyethylene glycol addition product of lauryl ether sodium sulfate to 38mm of 3 denier heat-fusing short fiber of polyester-polyethylene core sheath structure (NBF Fiber, Daiwa Spinning Co., Ltd.) and forming a hydrophilic web having a weighting of 20g/m$^2$ with 100% of said fiber using the carding machine 4. Following this, the fibers were fused together by laminating the webs of layer 1 and layer 2 and passing through a hot air type, heat treatment machine. Following calender processing, embossing was performed with an ultrasonic wave generation horn and engraving roll in which the surface area ratio of section C becomes 20% to obtain the nonwoven fabric of the surface material for the disposable diaper. When the performance of said nonwoven fabric was evaluated as a surface material using the absorber of a commercially available disposable diaper (Mary's, Kao Co., Ltd.), the results indicated in Table 3 were obtained.

Surface Liquid Flow

(Large): At the time of urination, urine is not absorbed quickly causing it to leak flowing on the surface of the surface material.

(Small): At the time of urination, urine is absorbed quickly and is unable to flow through the surface of the surface material.

Surface Liquid Backflow

(Small): The surface material feels dry with hardly any urine flowing back to the surface of the surface material.

(Large): The surface material feels sticky with a large amount of urine flowing back to the surface of the surface material.

Embodiment 12

Layer 1 was formed by adding 0.3 wt.% hydrophobic surface activating agent of which the main component is alkylphosphate K salt to the surface of 38mm of 2 denier heat-fusing short fiber of polyester-polypropylene core sheath structure (NBF Fiber, Daiwa Spinning Co., Ltd.) and forming a hydrophobic web having a weighting of 23g/m$^2$ with 100% of said fiber using the carding machine 22. Layer 2 was formed by adding 0.3 wt.% hydrophilic surface activating agent of which the main component is the polyethylene glycol addition product of lauryl ether sodium sulfate to 51mm of 3 denier heat-fusing short fiber of polyester-polyethylene core sheath structure (NBF Fiber, Daiwa Spinning Co., Ltd.) and forming a hydrophilic web having a weighting of 20g/m$^2$ with 100% of said fiber using the carding machine 4. Following this, cutting was performed with a web slitter at a pitch of 17cm of the portion which was not suctioned and removed of the hydrophilic web only and 16cm of the portion which was suctioned and removed followed by suction and removal. Continuing, the fibers were fused together by laminating the webs of the portions of layer 1 and layer 2 that were not suctioned and removed and passing through a hot air type, heat treatment machine. Embossing was performed with an ultrasonic wave generation horn and engraving roll in which the surface area ratio of section C becomes 15%. The central portion of layer 1 only was then slit and wound. When the performance of said nonwoven fabric was evaluated as a surface material using the absorber of a commercially available disposable diaper (Mary's, Kao Co., Ltd.), the results indicated in Table 4 were obtained.

Table 3

| | Layer 1 | Layer 2 | Embossing | Surface Liquide Flow | Surface Liquid Backflow | Total Evaluation |
|---|---|---|---|---|---|---|
| Embodiment 11 | Hydrophobic | Hydrophilic | Yes | Small | Small | ○ |
| Comparative Example 6 | " | " | No | Large | Small | × |
| " 7 | Hydrophilic | " | No | Small | Large | × |

Table 4

| | Layer 1 | Layer 2 | Embossing | Surface Liquide Flow | Surface Liquid Backflow | Liquid Leakage of Guide | Total Evaluation |
|---|---|---|---|---|---|---|---|
| Embodiment 12 | Hydrophobic | Hydrophilic | Yes | Small | Small | Hardly any | ○ |
| Comparative Example 8 | " | " | No | Large | Small | " | × |
| " 9 | Hydrophilic | " | No | Small | Large | Yes | × |

As can be understood from Embodiments 1-10, the surface material of this invention has both superior liquid permeability and backflow prevention. In particular, in Embodiments 6 and 7 in which layer 2 is not present on both ends in the horizontal direction of layer 1, since diffusion of liquid on the ends is inhibited, leakage prevention is improved phenomenally making it truly an ideal surface material.

In contrast to this, in Comparative Example 1, since the surface material does not have a double-layer structure, liquid backflow prevention is inferior. In Comparative Example 2, although the surface material has a double-layer structure consisting of hydrophobic and hydrophilic materials, since fiber density is essentially uniform, liquid permeability is inferior. In Comparative Example 3, since holes are provided in the upper hydrophobic layer, backflow prevention is inferior. On the other hand, in Comparative Example 4, since the surface area ratio of section C is less than 2%, liquid permeability is inferior. In Comparative Example 5, since the surface area ratio of section C is 50% or more, ventilation is poor and backflow prevention cannot be said to be adequate.

Therefore, one would have to say that those surface materials indicated in the comparative examples are still inadequate as surface materials of sanitary articles.

In addition, by using the nonwoven fabric that is provided by the method of this invention as the surface material of sanitary articles, together with realizing rapid absorption of body liquids, there is hardly any backflow of those absorbed body liquids to the surface of the surface material even when pressure is applied to the sanitary article. Thus, a feeling of dryness is maintained at all times and further, oozing and leaking of body liquids which have been absorbed in the horizontal direction of the nonwoven fabric can be inhibited. This allows inhibition and prevention of staining of clothing by body liquids that have been excreted as well as chafing of the skin, thereby resulting in reduction or elimination of the unpleasant feeling that is caused by the use of sanitary articles.

## Claims

1. A surface material for sanitary articles being composed of a first layer (1) which is located on the surface adapted to be in contact with the skin and a second layer (2) which is formed into a single unit with the first layer (1) on the surface opposite of that which is adapted to be in contact with the skin with its entire surface being essentially covered by the first layer (1), and with the first layer (1) comprising 50 to 100 % of hydrophobic fibers and the second layer (2) comprising 50 to 100 % of hydrophilic fibers, characterized in that at least the portion of the first layer (1) covering the second layer (2) has an embossed structure and possesses a first section (A) having a given fiber density, a second section (B) of which the fiber density is higher than said given fiber density of the first section (A), and a third section (C) which is located at a boundary between said first and second sections, where the area of the third section (C) occupies 2 to 50 % of the area of the entire surface material.

2. A preparing method of a surface material for sanitary articles comprising the steps of passing a first layer (1) which is located on the surface adapted to be in contact with the skin and which comprises 50 to 100 % of hydrophobic fibers, and a second layer (2) which is located on the surface of the first layer (1) opposite of that which is adapted to be in contact with the skin and which comprises 50 to 100 % of hydrophilic fibers, through an engraving roll in the form of a laminated structure followed by partial compression bonding and/or fusing to give it an embossed pattern,
**characterized in**
that with respect to the direction of flow of the fiber aggregate, the web of the second layer (2) is suctioned and removed at fixed intervals with respect to the horizontal direction prior to lamination of the first layer (1) and the second layer (2), and following lamination, the central portion of the portion that is essentially the first layer (1) only is slit and wound so that the second layer (2) does not exist at a fixed width on both ends in the horizontal direction of the sanitary article.

3. A preparing method of a surface material for sanitary articles as described in Claim 2 which is a fiber aggregate in which layer (1) is formed into a web using a carding machine from fibers of which the main component is heat-fusing short fiber, and which is prepared by fusing with a heating roll or heating fluid.

4. A preparing method of a surface material for sanitary articles as described in Claim 2 which is a fiber aggregate in which layer (2) is formed into a web using a carding machine from fibers of which the main component is heat-fusing short fiber, and which is prepared by fusing with a heating roll or heating fluid.

5. A preparing method of a surface material for sanitary articles as described in Claim 3 in which an embossed pattern is formed by compression bonding and/or fusing which possesses a first section (A), which has comparatively low fiber density, a second section (B), which has comparatively high fiber

density, and a third section (C), which is at the boundary of the first and second sections (A, B), such that the surface area ratio of the third section (C) is 2-50% with respect to the total surface area of the embossing.

## Patentansprüche

1. Oberflächenmaterial für Sanitärartikel, bestehend aus einer ersten Lage (1), die auf der Oberfläche angeordnet ist, die in Kontakt mit der Haut steht, und einer zweiten Lage (2), die mit der ersten Lage (1) auf der Oberfläche, die derjenigen, die in Kontakt mit der Haut ist, gegenüberliegt, zu einer einzigen Einheit gebildet ist, wobei ihre gesamte Oberfläche im wesentlichen von der ersten Lage (1) bedeckt ist, und wobei die erste Lage (1) 50 - 100 % hydrophobe Fasern und die zweite Lage (2) 50 - 100 % hydrophile Fasern aufweist,
**dadurch gekennzeichnet,**
daß wenigstens der Bereich der ersten Lage (1), der die zweite Lage (2) bedeckt, eine geprägte Struktur hat und einen ersten Abschnitt (A) mit einer gegebenen Faserdichte, einen zweiten Abschnitt (B), dessen Faserdichte höher ist als die gegebene Faserdichte des ersten Abschnitts (A), und einen dritten Abschnitt (C) besitzt, der in einem Grenzbereich zwischen dem ersten und zweiten Abschnitt angeordnet ist, wobei die Fläche des dritten Abschnitts (C) 2 - 50 % der Fläche des gesamten Oberflächenmaterials einnimmt.

2. Herstellungsverfahren für ein Oberflächenmaterial für Sanitärartikel, das die Schritte umfaßt: Hindurchführen einer ersten Lage (1), die auf der Oberfläche angeordnet ist, die in Kontakt mit der Haut steht, und die 50 - 100 % hydrophobe Fasern aufweist, und einer zweiten Lage (2), die auf der Oberfläche der ersten Lage (1) angeordnet ist, die derjenigen, die in Kontakt mit der Haut steht, gegenüberliegt, und 50 - 100 % hydrophile Fasern aufweist, durch eine Eindrückwalze hindurch in der Form einer laminierten Struktur, gefolgt von einem teilweisen Druckverbinden und/oder Verschmelzen, um ihm ein Prägemuster zu verleihen,
**dadurch gekennzeichnet,**
daß hinsichtlich der Flußrichtung der Faseransammlung das Gewebe der zweiten Lage (2) in feststehenden Intervallen bezüglich der horizontalen Richtung vor dem Laminieren der ersten Lage (1) und der zweiten Lage (2) angesaugt und entfernt wird, und nach dem Laminieren der mittlere Bereich desjenigen Bereichs, der im wesentlichen aus der ersten Lage (1) besteht, lediglich geschlitzt und gewickelt wird, so daß die zweite Lage (2) in einer festgelegten Breite an beiden Enden in horizontaler Richtung des Sanitärartikels nicht vorhanden ist.

3. Herstellungsverfahren für ein Oberflächenmaterial für Sanitärartikel nach Anspruch 2, das aus einer Faseransammlung besteht, bei der die Lage (1) mittels einer Kardiermaschine zu einem Gewebe aus Fasern geformt wird, deren Hauptkomponente aus wärmeschmelzenden kurzen Fasern besteht, und das durch Verschmelzen mit einer Wärmewalze oder einem Wärmefluid hergestellt wird.

4. Herstellungsverfahren für ein Oberflächenmaterial für Sanitärartikel nach Anspruch 2, das aus einer Faseransammlung besteht, bei der die Lage (2) mittels einer Kardiermaschine zu einem Gewebe aus Fasern geformt wird, deren Hauptkomponente aus wärmeschmelzenden kurzen Fasern besteht, und das durch Verschmelzen mit einer Wärmewalze oder einem Wärmefluid hergestellt wird.

5. Herstellungsverfahren für ein Oberflächenmaterial für Sanitärartikel nach Anspruch 3, bei dem mittels Druckverbinden und/oder Verschmelzen ein Prägemuster gebildet wird, das einen ersten Abschnitt (A) besitzt, der eine vergleichsweise niedrige Faserdichte aufweist, und einen zweiten Abschnitt (B), der eine vergleichsweise hohe Faserdichte aufweist, und einen dritten Abschnitt (C), der im Grenzbereich des ersten und zweiten Abschnitts (A, B) angeordnet ist, so daß das Oberflächenverhältnis des dritten Abschnitts (C) 2 - 50 % hinsichtlich der Gesamtoberfläche der Prägung beträgt.

## Revendications

1. Matériau de surface pour des articles sanitaires, composé d'une première couche (1) située sur la surface qui est prévue pour venir en contact avec la peau et une seconde couche (2) qui est formée en une unité unique avec la première couche (1) sur la surface opposée à celle qui est destinée à venir contact avec la peau, et dont la surface entière est essentiellement recouverte par la première couche

(1), la première couche (1) comprenant 50 à 100% de fibres hydrophobes et la seconde couche (2) comprenant 50 à 100% de fibres hydrophiles, caractérisé en ce qu'au moins la partie de la première couche (1) qui couvre la seconde couche (2) présente une structure bosselée et possède une première section (A) ayant une densité de fibres donnée, une seconde section (B) dont la densité des fibres est supérieure à ladite densité de fibres donnée de la première section (A), et une troisième section (C) qui est située à une frontière entre ladite première section et ladite seconde section, la superficie de la troisième section (C) occupant 2 à 50% de la superficie du matériau de surface entier.

2. Procédé de préparation d'un matériau de surface pour des articles sanitaires, comprenant les étapes consistant à faire passer une première couche (1) qui est située sur la surface prévue pour venir en contact avec la peau, et qui comprend 50 à 100% de fibres hydrophobes et une seconde couche (2) qui est située sur la surface de la première couche (1) à l'opposé de celle qui est prévue pour venir en contact avec la peau, et qui comprend de 50 à 100% de fibres hydrophiles, à travers un rouleau de gravure sous la forme d'une structure laminée, suivi d'un collage et/ou d'une fusion sous compression partielle afin de lui conférer un motif bosselé,
caractérisé en ce que, par rapport à la direction de l'écoulement des agrégats fibreux, la bande de la seconde couche (2) est aspirée et enlevée à des intervalles fixes par rapport à la direction horizontale avant de laminer la première couche (1) et la seconde couche (2), et en ce qu'à la suite du laminage, la partie centrale de la partie qui est essentiellement la première couche (1) uniquement est fendue et enroulée de sorte que la seconde couche (2) n'existe pas à une largeur fixe aux deux extrémités dans la direction horizontale de l'article sanitaire.

3. Procédé de préparation d'un matériau de surface pour des articles sanitaires, selon la revendication 2, qui est un agrégat fibreux dans lequel la couche (1) est formée en une bande en utilisant une machine de carde et à partir de fibres dont le composant principal est formé par des fibres courtes thermofusibles, et qui est préparée par fusion au moyen d'un rouleau chauffant ou d'un fluide chauffant.

4. Procédé de préparation d'un matériau de surface pour des articles sanitaires, selon la revendication 2, qui est un agrégat fibreux dans lequel la couche (2) est formée en une bande en utilisant une machine de carde à partir de fibres dont le composant principal est formé par des fibres courtes thermofusibles, et qui est préparée par fusion au moyen d'un rouleau chauffant ou d'un fluide chauffant.

5. Procédé de préparation d'un matériau de surface pour des articles sanitaires, selon la revendication 3, dans lequel on forme un motif bosselé par collage et/ou fusion sous compression, ledit motif présentant une première section (A), qui a une densité de fibres comparativement faible, une seconde section (B), qui a une densité de fibres comparativement élevée, et une troisième section (C), qui est située à la frontière de la première et de la seconde section (A, B), de telle sorte que le rapport de superficie de la troisième section (C) est compris entre 2 et 50% par rapport à la superficie totale du bosselage.

FIG 1

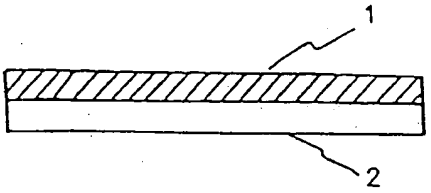


FIG 2

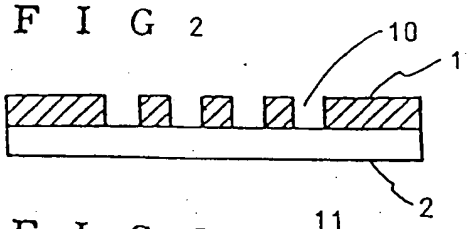


FIG 3

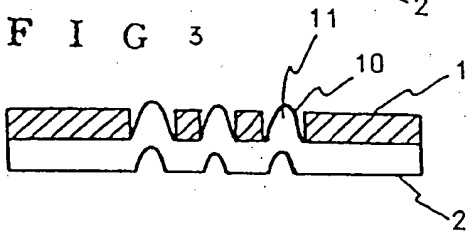


FIG 4

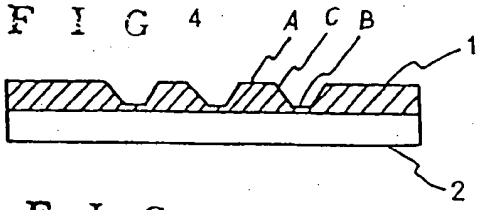


FIG 5

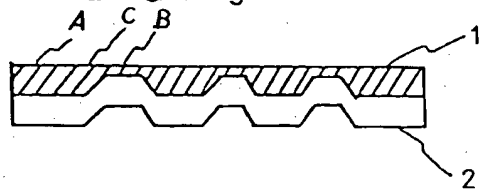


FIG 6

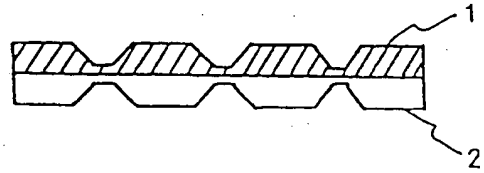


FIG 7

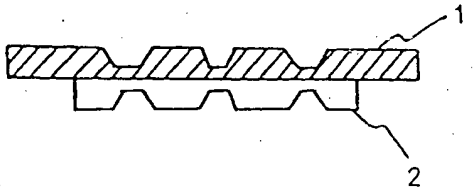


FIG 8

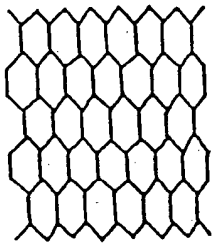

FIG 9

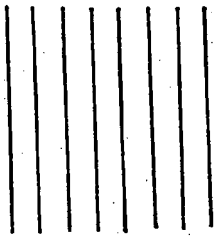

FIG 10

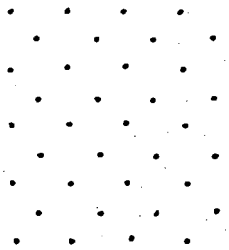

FIG 11

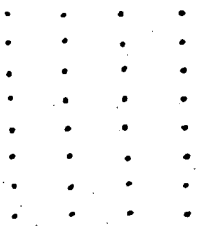

FIG 12

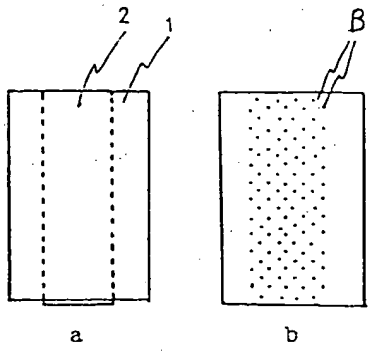


FIG 13

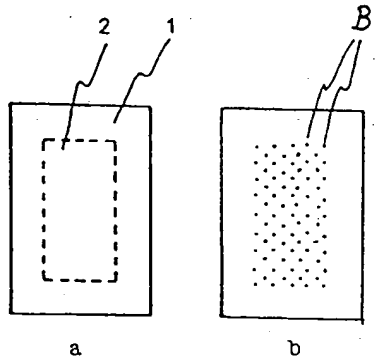


FIG 14

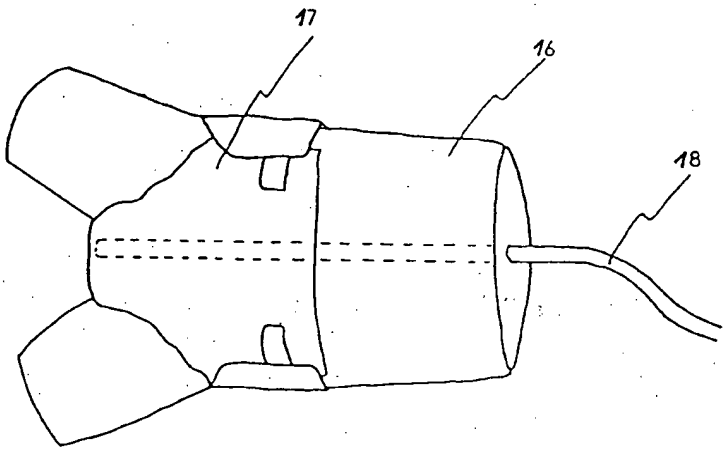

FIG 15

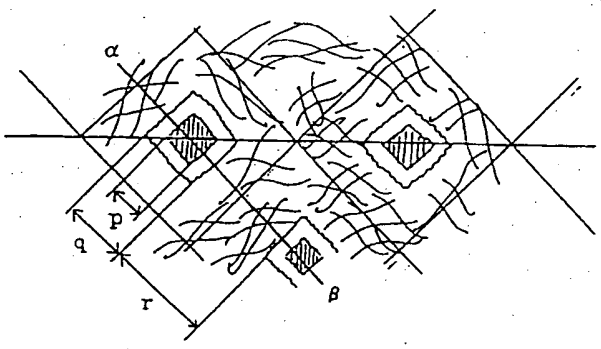


FIG 16

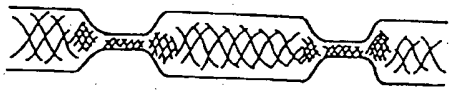

FIG 17

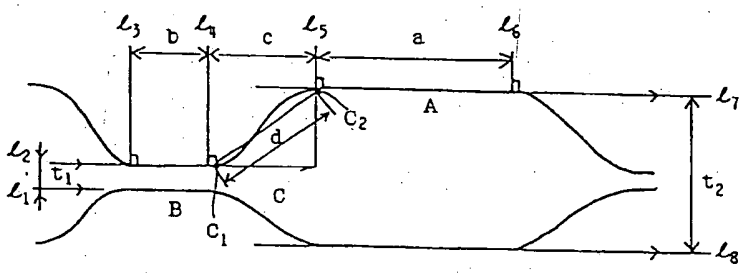


FIG 18